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AIR FORCE

HUMAN RESOURCES

ADVANCED ON-THE-JOB TRAINING SYSTEMS (AOTS) PERFORMANCE STUDY

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January 1991

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Approved for public release; distribution is unlimited.

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NOTICE

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Computer-Based Training (CBT) was found to be useful for improving Air Force personnel knowledge and performance on maintenance tasks. CBT modules, involving Computer-Assisted Instruction and Interactive Video, were developed by the Advanced On-the-job Training System (AOTS) subject-matter experts for seven maintenance tasks: four modules for Aircraft Maintenance Unit (AMU) and three for Jet Engine Mechanic (JEM). Treatment and control groups were composed of AMU or JEM personnel and certified on the identified maintenance tasks. After reviewing the CBT within their specialty, treatment group subjects were compared with the control groups on knowledge and performance evaluations. The treatment groups scored significantly higher on five of the seven knowledge tests. In addition, the treatment groups scored significantly better on two of the seven performance tests, but scored at a comparable level with the control groups on the remaining performance tests. These findings reveal that CBT not only improves task knowledge but also has a slight bolstering effect on performance of maintenance tasks. Additional results from interviews with treatment subjects add to the efficacy of this technology in the operational setting.

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This publication is primarily a working paper. It is published solely to document work performed.

SUMMARY

The Advanced On-the-job Training System (AOTS) was an Air Staff-directed, AFHRL-developed, prototype system which designed, developed, and tested a proof-of-concept prototype AOTS within the operational environment of selected workcenters at Bergstrom AFB, TX and Ellington ANGB, TX from August 1985 through 31 July 1989. This performance study report is a part of the System-Level Testing and Evaluation of the AOTS. This study investigated the impact of Computer-Based Training (CBT) modules on Air Force maintenance task knowledge and task performance by comparing airmen who reviewed the CBT modules (treatment group) with a comparable group of airmen who did not review the modules (control group). Findings from this study showed that airmen receiving CBT scored significantly higher on a majority of tasks in terms of knowledge and also scored higher on two of the seven tasks in terms of performance. Findings from structured interviews with treatment subjects on the efficacy of CBT for Air Force maintenance training are also reported.

PREFACE

This paper documents a performance study conducted to investigate the impact of Computer-Based Training modules on Air Force maintenance task training. As a part to the System-Level Testing of the Advanced On-the-job Training System (AOTS), it investigated differences in task knowledge and task performance by comparing airmen who reviewed CBT modules with a control group of airmen who received traditional on-the-job training (OJT). The AFHRL work unit number for the project is 2557-00-02. The Air Force AOTS manager is Major Jack Blackhurst.

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Introduction

Computer Based Training (CBT) is considered a viable and cost-effective training tool. After the initial cost of development, CBT can be used continuously to provide standardized training. It can supplement training conducted by trainers, reducing the need to depend on equipment or personnel. In addition, the audio-visual presentation mode has advantages over written instruction manuals. All these features add to the potential of CBT to improve training in the operational setting.

The past decade has seen a proliferation of research on the efficacy of CBT (Clements, 1986; Dalgaard, 1984; Kulik, 1983; Kulik, Bangert, & Williams, 1983; Kulik & Bangert-Drowns, 1984; Kulik & Kulik, 1987). Research findings on the effectiveness of these technologies to enhance student achievement are often mixed, ranging from little or no effect to substantial gains. Kulik (1983), however, argued that several findings were now clear. Based on two meta-analysis reviews conducted at the University of Michigan, he concluded that Computer Aided Instruction (CAI): 1) has the potential to improve student achievement; 2) fosters positive attitudes toward computers; and 3) reduces learning time. These conclusions were reaffirmed by Kulik & Kulik (1987) in a separate meta-analysis of 199 CBT studies conducted at the primary, secondary, and university levels.

Kearsley (1983) argued that CBT can improve training effectiveness because of the high level of feedback and practice it provides. Feedback, according to Kearsley, ensures that students understand the materials being taught while practice provides students with an opportunity to increase their skill levels and retention rates. He warns us, however, that CBT is unlikely to have a significant effect on job performance or training effectiveness if the CBT courses themselves are poorly developed.

Although a major use of Computer Based Training has been in technical schools, application of this technology in the operational job setting has generated a substantial amount of interest. Computer Assisted Instruction and Interactive Video Disk technology, for example, can enhance the acquisition of knowledge and facilitate task performance in the operational setting. Previous research on the efficacy of this technology has focused on the effects of computer-based training lessons with minimal emphasis on the supplemental effects of CBT on hands-on training. The portability of this technology to the work setting, however, makes it possible to investigate the supplementary effects that CBT modules have on hands-on training.

Although AF task training is conducted by using a technical manual, or Technical Order (T.O.), most maintenance training lacks standardization. The majority of task training is conducted on an apprenticeship basis: over-the-shoulder, learning by doing, and with occasional reference to the T.O.. While this method is the accepted mode of AF On-the-job training (OJT), this study is primarily focused on the supplemental effects of CBT on hands-on training. The question of interest to this study is -- What are the effects of CBT on the task knowledge and performance of Air Force (AF) personnel who have already been certified on the particular task or tasks in question? Certification on a task is a formal indication that an individual has the ability to perform that task (AFR 50-23).

Method

Subjects. The majority of the participants in this study were first-term airmen from two Air Force specialties: Jet Engine Mechanic (JEM) and Aircraft Maintenance for the F-4 aircraft. There were 24 subjects from the 67th Tactical Reconnaissance Wing (TRW), composed of 12 treatment subjects from the 12th Aircraft Maintenance Unit (AMU) and an equal number of control subjects from the 91st AMU. Because of the limited number of JEM personnel at Bergstrom AFB, the treatment and control groups were from 2 different bases. Bergstrom AFB (67th Aircraft Generation Squadron [AGS]) provided ten treatment subjects and ten AF personnel from a comparable F-4 base, George AFB, California (35th/37th AGS), were used as control subjects. Subjects in both the treatment and control groups were selected on the basis of two criteria: time in service, and recency of certification (within the past 2 years) on the tasks of interest to this study. Because of the limited availability of personnel, the criteria for selection were not completely satisfied, requiring a closer examination of the background characteristics of both groups.

A comparison of the participants did not reveal any significant differences in several key areas: time in service, rank, number of times tasks were performed, and last time (in weeks) each task was performed. Table 1 shows a comparison of demographic characteristics (time in service and rank) for both the AMU and JEM groups. An analysis of variance for time in service (months) was performed. The ANOVA showed no significant difference in time in service for the treatment and control groups within either the AMU or JEM samples. As Table 1 clearly shows, the treatment and control groups for the AMU sample were similarly distributed with regard to rank. A non-parametric test, Fischer's Exact Test of Association, performed on the JEM sample showed no significant differences in distribution of ranks ($p \leq .08$).

Tables 2 and 3 show a comparison of the control and treatment groups based on the number of times a task was

performed and the last time a task was performed. Based on the subjects' self-report of each of these variables, a univariate analysis of variance was performed. This analysis showed that the treatment and control groups (both AMU and JEM) did not differ on either the number of times a particular task was performed or the number of weeks since last performance. Thus, overall these two groups appear to be equivalent. Based on this apparent equivalence and our knowledge of the AF personnel assignment process, it was assumed, for the purposes of this study, that AMU and JEM personnel had been randomly assigned to their respective units.

Table 1

Comparison Of Demographic Data For JEM and AMU Treatment And Control Groups - AOTS Performance Study

	AIRCRAFT MAINTENANCE		JET ENGINE MECHANIC	
TIME IN SERVICE (months)	Treatment [a]	Control [b]	Treatment [c]	Control [b]
Mean	51.10	45.36	52.22	28.30
SD	10.00	11.00	9.00	10.00
F	.193		1.288	

RANK	Treatment	Control	Treatment	Control
Amn-SrA	66%	66%	66%	100%
Sgt-SSgt	34%	34%	34%	0%

Note. The control group for JEM came from George AFB. All other treatment and control groups came from Bergstrom AFB.

[a] $n = 11$. [b] $n = 10$. [c] $n = 9$.

* $p < .05$ ** $p < .01$

Table 2

Comparison Of Task Relevant Information For JEM Treatment And Control Groups

WEEKS SINCE LAST PERFORMANCE

		TASK		
		L10010	L10012	L10017
TREATMENT[a]				
	Mean	15.89	17.89	16.33
	SD	31.65	31.08	31.44
CONTROL[b]				
	Mean	10.70	11.00	8.90
	SD	19.45	19.41	19.20
	F	.190	.343	.396

NUMBER OF TIMES PERFORMED

		L10010	L10012	L10017
TREATMENT[a]				
	Mean	7.44	7.56	9.87
	SD	6.38	6.25	8.47
CONTROL[b]				
	Mean	12.60	12.30	18.90
	SD	8.29	7.39	11.22
	F	2.20	2.25	3.93

[a] $n = 9$. [b] $n = 10$

[*] $p < .05$ [**] $p < .01$

Table 3

Comparison Of Task Relevant Information For AMU Treatment And Control Groups

WEEKS SINCE LAST PERFORMANCE

		TASK			
		I10308	J10008	J10032	J10159
TREATMENT[a]	Mean	1.10	16.70	5.20	5.20
	SD	0.32	25.23	3.85	3.85
CONTROL[b]	Mean	1.00	36.27	2.64	2.64
	SD	0.00	40.47	2.11	2.11
	F	1.00	1.74	3.67	3.67

NUMBER OF TIMES PERFORMED

		I10308	J10008	J10032	J10159
TREATMENT[a]	Mean	162.90	1.10	9.40	9.40
	SD	212.26	1.60	8.47	8.47
CONTROL[b]	Mean	404.36	9.27	96.27	93.54
	SD	359.85	12.78	139.98	140.83
	F	3.41	4.01	3.82	3.54

[a] $n = 11$. [b] $n = 10$.

* $p < .05$ ** $p < .01$

Procedure. A posttest-only control group design (Campbell & Stanley, 1963), depicted in Figure 1, was used to investigate the effects of CBT. Our decision to use the posttest only design was based on the assumption that AMU and JEM personnel were randomly assigned to their respective units by the AF personnel assignment system. Randomization ensures probabilistic equivalence of the treatment and control groups thus eliminating the need for a pretest (Campbell and Stanley, 1963; Campbell and Cook, 1979). The apparent equivalence of the two groups as demonstrated in Tables 1, 2, and 3 supported the assumption of randomization. Both knowledge and performance tests were used to measure the effects attributed to viewing the CBT.

	CBT	Knowledge Test	Performance Test
Treatment	Yes	Yes	Yes
Control	No	Yes	Yes

Figure 1. Posttest-only control group design

Four AMU and three JEM maintenance tasks were used during this study. Computer training lessons were developed for these specific tasks because they are high priority training tasks, typically performed in the operational setting. Of the 4 AMU tasks, 2 involved Computer Assisted Instruction (CAI) and 2 were Interactive Video Disks (IVD). Only one of the JEM training modules is an IVD lesson (or module).

CAI is a programmed lesson whose pace is controlled by the viewer via a keyboard. The training lesson involves a set of sequenced steps presented on the video monitor, with graphic illustrations to accentuate key points. The IVD, however, is a video disc with a description of the task as it is performed. The audio-video presentation is highlighted by close-ups or graphics to emphasize key aspects of the training lesson. The viewer interacts with the presentation by touching the response options on the video monitor to answer questions presented in the lesson.

The following are the identified AMU and JEM CAI/IVD modules:

AMU CAI Modules:		AMU IVD MODULES:	
I10308	Install Drag Chute	J10008	Service Main Landing Gear Strut
J10032	Remove Main Landing Gear Wheel/Tire	J10159	Install Main Landing Gear Wheel/Tire

JEM CAI Modules:		JEM IVD Module:	
L10017	Close CSD Drive Doors	L10010	Install CSD Generator Assembly
L10012	Install CSD/Generator Dome Assembly		

The CAI and IVD modules were viewed by the treatment groups at the Human Resources Lab (Bldg. 1808, Bergstrom AFB, TX). After viewing the training module, each subject completed a knowledge test. Control group subjects, however, completed the knowledge tests without viewing the CBT. With the exception of the control group at George AFB, all of the knowledge and performance evaluations were conducted at Bergstrom AFB.

All performance evaluations were administered under controlled conditions using performance evaluation checklists (PECs). That is, the JEM performance tasks were completed at the Field Training Detachment lab and the AMU performance evaluations were conducted in a hangar, using a dedicated F-4 aircraft. All of the performance evaluations were administered by the Universal Energy Systems (UES), Inc. subcontractors -- two retired AF personnel with maintenance experience in the AF specialties of interest to this study.

The knowledge tests (KTs) and performance evaluation checklists (PECs) used in this study were products of the AOTS Evaluation Subsystem. The KTs were multiple choice tests based on task proficiency knowledge objectives. PECs were used to measure hands-on job performance. The PEC is composed of those performance objectives whose completion constitutes the successful completion of a task. The examiner administers the PEC by checking pass or fail on each task objective during an over-the-shoulder evaluation. (see Hedge & Teachout, 1986)

JEM and AMU Subject Matter Experts (SME) from the AOTS Instructional Systems Team provided logistical assistance during performance evaluations. They scheduled evaluations, procured maintenance tools, and established the inter-rater reliability (percent of agreement between UES evaluator and SME on performance evaluation checklist). Inter-rater reliability was achieved at the 90 percent level for all tasks.

In addition to the knowledge and performance tests, individual interviews were conducted with 15 treatment subjects. The structured interview was composed of multiple choice and open ended questions. Interview questions involved the user-friendliness of the CBT, comparison with AF OJT, and efficacy of implementing this technology in the operational setting. The administration time for the 16 interview questions was 10 to 15 minutes (Appendix A).

Results

Knowledge and Performance Tests. Tables 4 and 5 contain the means and standard deviations of the percentage scores for each knowledge and performance test broken down by test group (i.e., JEM and AMU). Scores were calculated simply by using the number of correct responses per test divided by the total number of items per test.

A univariate analysis of variance (ANOVA) was performed for the knowledge and performance tests associated with each of the tasks. The purpose of this analysis was to determine whether differences in knowledge or performance existed between the treatment and control groups with regard to each of the tasks. The ANOVA revealed a significant difference ($p <.01$) in knowledge test scores for two (Service Main Landing Gear Strut and Install Main Landing Gear Wheel/Tire) of the four AMU tasks. Here, the group receiving CBT scored higher than the group not receiving CBT on two tasks and at a comparable level on the other two tasks. In the JEM sample, the treatment group scored significantly higher on all three knowledge tests ($p <.01$ for Install CSD Generator Assembly and Install CSD/Generator Dome Assembly; $p < .05$ for Close CSD Drive Doors). A multivariate analysis of variance (MANOVA) showed a significant difference ($p < .01$) between the treatment and control groups in the JEM sample for knowledge tests. A MANOVA was not performed for the AMU sample because the associated variance-covariance matrix was not homogeneous.

Although there were significant differences on most of tasks with regard to knowledge tests, this finding was not as prevalent for performance test scores. Within the AMU, three of the four performance scores were the same for both groups. The treatment group did, however, score significantly higher ($p <.05$) than the control group on one task -- Install the Wheel and Tire Assembly. Looking at the JEM specialty, the treatment group scored at a comparable level with the control group on two of the tasks (Close CSD Doors, Install CSD Generator Dome Assembly), and significantly ($p <.05$) higher than the control group on the remaining task (Install CSD Generator Assembly).

Table 4

Knowledge and Performance Test Scores For JEM

KNOWLEDGE TEST

		TASK		
		L10010	L10012	L10017
TREATMENT[a]				
	Mean	84.56	95.90	87.03
	SD	11.03	5.12	16.20
CONTROL[b]				
	Mean	66.66	67.36	65.00
	SD	11.11	13.99	21.44
	F	12.38**	33.28**	6.27*

PERFORMANCE TEST

		L10010	L10012	L10017
TREATMENT[a]				
	Mean	84.68	79.32	100.00
	SD	11.70	21.86	0.00
CONTROL[b]				
	Mean	95.94	89.76	91.43
	SD	6.01	8.29	18.07
	F	7.19*	1.98	2.07

[a] $n = 9$. [b] $n = 10$

* $p < .05$ ** $p < .01$

Table 5

Knowledge and Performance Test Scores For AMU

		KNOWLEDGE TEST			
		TASK			
		I10308	J10008	J10032	J10159
TREATMENT[a]					
	Mean	90.00	84.49	55.99	90.41
	SD	25.52	7.97	20.66	10.03
CONTROL[b]					
	Mean	81.81	68.17	59.99	78.78
	SD	7.04	14.01	23.67	8.43
	F	1.05	10.45**	0.17	8.33**

		PERFORMANCE TEST			
		I10308	J10008	J10032	J10159
TREATMENT[a]					
	Mean	96.66	83.33	97.50	98.32
	SD	5.67	26.68	5.27	2.68
CONTROL[b]					
	Mean	100.00	83.98	94.32	88.32
	SD	0.00	13.17	10.25	11.24
	F	3.83	0.01	0.77	7.51*

[a] $n = 11$. [b] $n = 10$.

* $p < .05$ ** $p < .01$

Discussion

The results of this study support the use of CBT in the operational job setting. The knowledge, performance tests and interview results reveal benefits of computer based training lessons, even with AF personnel previously certified on maintenance tasks.

Higher knowledge test scores among the treatment groups were expected. Because the knowledge tests are based on the computer training lessons, it is not surprising that the treatment group earned higher scores. However, the finding that the majority of knowledge tests were found to be significant across both specialties is noteworthy. It is noteworthy because all participants had been previously certified on these tasks. Nonetheless, the control groups scored substantially lower than their counterparts. The higher scores on the knowledge tests were greatest on the most complex tasks in both the AMU (Service Main Landing Gear Strut) and JEM (Install CSD Generator Assembly and Install CSD Generator Dome Assembly). Unlike the knowledge test results, the outcome of the performance tests was not as compelling.

The treatment and control groups scored at a comparable level on the majority of performance tests for both the JEM and AMU. The treatment groups did, however, perform significantly better on two of the tasks, one from each specialty. Given this finding, it is conceivable that the use of CBT may accelerate the learning of maintenance tasks. CBT may also be useful as a refresher course to enhance knowledge and performance proficiency. Some observations during the study reveal the potential benefits of using CBT to supplement the training material in the Technical Order (T.O.).

The participants' use of the T.O. during the performance evaluation was informative. According to the respondents, the T.O. is not as well organized and thorough as the computer-based training lesson. When participants referred to the T.O. during the performance test, some individuals experienced difficulty locating and following the directions. In contrast to the T.O., the CBT was viewed as "alive" with various ways of emphasizing detail and critical steps in performing the maintenance tasks.

The participants' perception of CBT was favorable. They viewed CBT as a user-friendly training tool that, combined with conventional AF OJT, could expedite maintenance task training. Despite the participants' certification status, they felt the CBT added to their knowledge. IVD was preferred over CAI because of the audio-video presentation of the task, combined with the interactive characteristics of the training lesson. They highly recommended its implementation in the operational setting and felt other trainees could benefit from the lessons.

This study is not without the inherent limitations of field-based research. For example, there was no opportunity to investigate the psychometric properties (validity, reliability) of the test instruments before their use. However, these instruments were developed by SMEs and validated by OJT supervisors. Another constraint was the small size of control and treatment groups.

Finally, we were not able to control the assignment of participants to either the treatment or control groups. Consequently, a major assumption behind this study was that maintenance personnel were randomly assigned to their respective units by the AF personnel system. This assumption is critical to our research design and necessary to ensure equivalence between test groups, but may not be true. We feel, however, that this assumption was justified given the apparent equivalence between our test groups on variables such as time in service, rank, number of times a task was performed, and time since last performance.

Future research efforts on the potential of CBT in the operational setting should investigate the effects of human factor variables. Despite the benefits derived from implementing this training technology, it will not be realized without the acceptance of the users. Given the minimal change that has occurred in AF OJT over the years, acceptance and integration of CBT technology may not be easy. Consequently, additional research on AF OJT will be needed to heighten our awareness of important factors conducive to implementing this technology in the operational setting.

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APPENDIX A

Analysis of Interview Responses

A content analysis of the interview responses revealed a favorable perception of this technology in the work setting. As noted on Table 4, respondents felt the CBT was easy to use and understand. Eighty percent reported that the CBT was helpful in preparing for both the knowledge and performance tests. They felt the use of CBT would result in a time savings and provide more organized and detailed information. In addition, they felt the performance tests provided a more valid measure of task proficiency.

AOTS PERFORMANCE STUDY
INTERVIEW
N=15

CBT---	YES	NO
Easy to operate?	93%	7%
Easy to follow?	86%	14%
Reduce time to learn task?	87%	13%
Adequately prepare traineeS to perform task?	80%	20%
More organized information?	87%	13%
Trainees should receive more training via CBT?	80%	20%
Are performance tests better for evaluating task proficiency than current OJT method?	71%	29%

APPENDIX B

Sample Performance Evaluation Checklist and Knowledge Test

CAI LESSON/TASK ID/PEC/KNOWLEDGE TEST LISTING

CAI ID#- 42-1-1-1-1

CAI TITLE- CSD/GEN DOME ASSY INST.

TASK ID#- L10012

TASK TITLE- INSTALL A CONSTANT SPEED DRIVE/GENERATOR DOME

OSR CROSS-REFERENCE- H00243

PEC/OTG- ATTACHED

KNOWLEDGE TEST- ATTACHED

****
Item 203: Oral Test Guide

Initial Author: Haapanen, Bob
Initial Date: 09 Dec 1987
Last Modified by: Haapanen, Robert
Modify Date: 11 Jul 1988

TERMINAL BEHAVIOR OBJECTIVE : INSTALL A CONSTANT SPEED DRIVE/GENERATOR DOME IN ACCORDANCE WITH TECHNICAL ORDER 1F-4C-10.

WEAPON SYSTEM : RF-4C and F-4D; J79-15 ENG

ACFT CONFIG : N/A

COMPONENT CONFIG : N/A

ESTIMATED TIME : 1 Hour

TEAM TASK CODE : Not a team task
PREREQUISITE TASK: N/A

TEM for EXAMINEE : CTK
: TORQUE WRENCH 0-150 INCH POUNDS
: TORQUE WRENCH 0-300 INCH POUNDS

TEM for EVALUATOR: Task Checklist, Pencil, and Clipboard
EVALUATOR INSTRUCTIONS:
o Administer the evaluation in the shop.

o During the evaluation you may ask the examinee to explain any steps that he/she is performing and you are unable to observe. Simply say "TELL ME WHAT YOU ARE DOING NOW." Use the accompanying checklist to record the examinee's actions or verbal responses. In the space provided to the right of each checklist activity number, circle Y if the examinee performed the step correctly, circle N if the examinee performed the step incorrectly. Circle U if the examinee was unable to perform the step due to conditions outside of his of her control or you were unable to observe the step for some other reason.
o Read the following instructions slowly and clearly to the examinee. Substitute the word(s) in parentheses as requried. Emphasize that the examinee should perform steps alone, but can have assistance when necessary, and that the examinee is to verbally tell you when he/she makes a visual check.

SAY TO THE EXAMINEE: INSTALL A CONSTANT SPEED DRIVE/GENERATOR DOME IN ACCORDANCE WITH TECHNICAL ORDER 1F-4C-10. Obtain all tools, materials, and equipment before starting the task. Perform all steps alone except when to do so might result in injury to personnel or damage to equipment. TELL ME IF YOU DEVIATE FROM THE TECHNICAL ORDER SUCH AS PERFORMING A STEP OUT OF SEQUENCE. TELL ME WHEN YOU PERFORM A STEP OR CHECK THAT I CAN NOT SEE YOU PERFORMING, SUCH AS ENSURING THAT SWITCHES ARE IN THE CORRECT POSITION OR THAT SAFETY DEVICES ARE INSTALLED. WHEN YOU MAKE A CHECK, TELL ME EXACTLY WHAT YOU ARE LOOKING FOR AND WHAT YOU FIND.
Tell me when you are ready to begin the task and when you have completed the

task.

DID THE EXAMINEE PERFORM OR SAY HE/SHE SHOULD PERFORM THE FOLLOWING ACTIONS:

****

Item 148: Performance Checklist

1 Y N U Safety the screw securing the bracket (14) on the forward left side of the generator with .032 lockwire? (20KVA only)

2 Y N U Ensure seals part numbers 53-50031-7 and 53-50017-63 were serviceable?

3 Y N U Carefully feed the electrical leads through the CSD dome to avoid damaging the terminal block insulator dividers?

4 Y N U Secure electrical lead X75 to terminal G?

5 Y N U Secure electrical lead X55 to terminal T1?

6 Y N U Secure electrical lead X56 to terminal T2?

7 Y N U Secure electrical lead X57 to terminal T3?

8 Y N U Secure electrical lead X58 to terminal F?

9 Y N U Secure electrical lead X65 to terminal P?

10 Y N U Ensure the flange on the aft end of the dome was inserted into the split of the dome locking ring?

11 Y N U Secure the left dome strut to the air oil cooler pad?

12 Y N U Ensure the Permacel tape on the left dome strut was not damaged during the installation?

13 Y N U Secure the right dome strut to the air oil cooler pad?

14 Y N U Ensure the Permacel tape on the right dome strut was not damaged during the installation?

15 Y N U Torque the bolts securing the dome struts (6 and 15) to 70 inch pounds?

16 Y N U Safety the bolts securing the dome struts with .032 lockwire?

17 Y N U Ensure the mismatch between the leading edge of the strut and the airoil cooler strut pads were less than .090 inch?

18 Y N U Ensure the mismatch between the sides of the strut and door assemblies the mold line of the strut pads were less than .050 inch?

19 Y N U Position the electrical leads to provide maximum clearance between the leads and the dome structure?

20 Y N U Torque the nuts securing the lead's terminals to 60-85 inch pounds?

21 Y N U Connect electrical connector 3P616 to the aft end of the CSD?

22 Y N U Safety the screw (16) securing the CSD electrical lead to CSD with .032 lockwire (20 KVA only)?

23 Y N U Safety the three bolts (8) securing the CSD electrical lead to the CSD with .032 lockwire (30 KVA only)?

24 Y N U Install the seal (2) on the forward end of the anti icing line with the open face of the seal positioned forward?

25 Y N U Install a seal on between the aft end of the anti-icing line and the CSD/GEN forward coupling?

26 Y N U Lubricate the bolts securing the anti-icing line to the forward coupling?

27 Y N U Torque the bolts securing the anti-icing line to the forward coupling to 250-270 inch pounds?

28 Y N U Safety the bolts securing the anti-icing line to the forward coupling with .032 lockwire?

29 Y N U Lubricate the inner surface of bushing (12) with VV-P-236?

30 Y N U Insert the bushing (12) into dome with the split facing aft?

****

3. Item 1073: True False Question

The protective caps and plugs are removed before the CSD dome assembly is installed.

a. True
b. False

Correct response is: A

Feedback for incorrect response:
None specified.

****

4. Item 1074: True False Question

The nutplate bracket is installed onto the 20 KVA Generator before the dome assembly in installed.

a. True
b. False

Correct response is: A

Feedback for incorrect response:
None specified.

****

5. Item 1075: True False Question

To prevent damage to the generator electrical connector it is recommended that you tape the generator leads together before routing the leads through the dome.

a. True
b. False

Correct response is: A

Feedback for incorrect response:
None specified.

****

6. Item 1078: True False Question

Color coding is used to identify which electrical lead connects to which generator terminal post.

a. True
b. False

Correct response is: B

Feedback for incorrect response:
None specified.

****

7. Item 1082: True False Question

The electrical leads may touch the dome assembly only if the leads have been properly insulated.

a. True
b. False

Correct response is: B

Feedback for incorrect response:
None specified.

****

8. Item 1085: True False Question

A bushing in positioned around the electrical lead in the left strut area to prevent chafing.

a. True
b. False

Correct response is: A

Feedback for incorrect response:
None specified.

****

9. Item 1087: True False Question

Damaged threads on the CSD oil supply port will require the CSD to be replaced.

a. True
b. False

Correct response is: B

Feedback for incorrect response:
None specified.

****

10. Item 1076: Multiple Choice Question

The nutplate bracket secures the

A. CSD electrical lead to the generator.
B. engine electrical harness to the dome assembly.
C. anti-icing line to the generator.
D. CSD oil drain line to the CSD unit.

Correct response is: A

Feedback for alternative A
Correct.

Feedback for alternative B
Incorrect, it secures the CSD electrical lead to the generator.

Feedback for alternative C
Incorrect, it secures the CSD electrical lead to the generator.

Feedback for alternative D
Incorrect, it secures the CSD electrical lead to the generator.

****

11. Item 1077: Multiple Choice Question

What engine component, by design, provides the dome strut mounting pads?

A. The air-oil cooler.
B. Engine front frame.
C. Compressor case.
D. Transfer gearbox.

Correct response is: A

Feedback for alternative A
Correct.

Feedback for alternative B
Incorrect, the air-oil cooler provides the dome strut mounting pads.

Feedback for alternative C
Incorrect, the air-oil cooler provides the dome strut mounting pads.

Feedback for alternative D
Incorrect, the air-oil cooler provides the dome strut mounting pads.

****

12. Item 1079: Multiple Choice Question

What engine component MUST have been installed prior to installing the CSD dome assembly?

A. The CSD dome locking ring and the air-oil cooler assembly.
B. The generator electrical harness and the air-oil cooler assembly.
C. CSD oil lines and the generator electrical leads.
D. CSD oil lines and the CSD dome locking ring.

Correct response is: A

Feedback for alternative A
That's correct

Feedback for alternative B
Incorrect, its the CSD dome locking ring and the air-oil cooler assembly.

Feedback for alternative C
Incorrect, its the CSD dome locking ring and the air-oil cooler assembly.

Feedback for alternative D
Incorrect, its the CSD dome locking ring and the air-oil cooler assembly.

****

13. Item 1080: Multiple Choice Question

Why must the CSD dome struts be properly aligned with the air-oil cooler strut pads?

A. To insure clearance between the struts and the CSD electrical leads and the oil lines.
B. To allow installation of the dome assenbly to the air-oil cooler mount bolts.
C. To prevent chafing between the generator and the electrical leads.

Correct response is: A

Feedback for alternative A
Correct.

Feedback for alternative B
Incorrect, it is to insure clearance between the struts and the CSD electrical leads and the oil lines.

Feedback for alternative C
Incorrect, it is to insure clearance between the struts and the CSD electrical leads and the oil lines.

****

14. Item 1081: Multiple Choice Question

What tool is used to perform the dome strut to the air-oil cooler pad alignment check?

A. Thickness gage.
B. Straight edge ruler.
C. Depth micrometer.
D. Outside micrometer.

Correct response is: A

Feedback for alternative A
Correct

Feedback for alternative B
Incorrect, the thickness gage is used to perform the dome strut to the air-oil cooler pad alignment check.

Feedback for alternative C
Incorrect, the thickness gage is used to perform the dome strut to the air-oil cooler pad alignment check.

Feedback for alternative D
Incorrect, the thickness gage is used to perform the dome strut to the air-oil cooler pad alignment check.

****

15. Item 1083: Multiple Choice Question

How is the forward anti-icing line seal positioned?

A. With the open face of the seal forward.
B. With the open face of the seal aft.
C. Inside the CSD dome receptacle.
D. On the forward end of the anti-icing line.

Correct response is: A

Feedback for alternative A
Very Good.

Feedback for alternative B
Incorrect, it is positioned with the open face of the seal forward.

Feedback for alternative C
Incorrect, it is positioned with the open face of the seal forward.

Feedback for alternative D
Incorrect, it is positioned with the open face of the seal forward.

****
16. Item 1084: Multiple Choice Question

What type of lubricant is used on the anti-icing line mount bolts during installation?

A. MIL-L-25681.
B. MIL-L-7808.
C. Petrolatum.
D. Moly Grade 3 grease.

Correct response is: A

Feedback for alternative A
Very Good.

Feedback for alternative B
Incorrect, MIL-L-25681 is the lubricant used on the anti-icing line mount bolts during installation.

Feedback for alternative C
Incorrect, MIL-L-25681 is the lubricant used on the anti-icing line mount bolts during installation.

Feedback for alternative D
Incorrect, MIL-L-25681 is the lubricant used on the anti-icing line mount bolts during installation.

****
17. Item 1086: Multiple Choice Question

Which component passes through the right CSD dome strut?

A. The CSD oil supply and return lines.
B. The CSD oil supply and drain lines.
C. The CSD/GEN electrical harness.
D. The CSD oil return and drain lines.

Correct response is: A

Feedback for alternative A
Correct.

Feedback for alternative B
No. The CSD oil supply and return lines pass through the right CSD dome strut.

Feedback for alternative C
No. The CSD oil supply and return lines pass through the right CSD dome strut.

Feedback for alternative D
No. The CSD oil supply and return lines pass through the right CSD dome strut.

****
18. Item 1088: Multiple Choice Question

What is placed on the CSD oil supply and return lines to prevent chafing.

A. Chafe guard (spril wrap).
B. Spacer between oil lines.
C. Metal chafe blanket.
D. Adel clamps.

Correct response is: A

Feedback for alternative A
Very Good.

Feedback for alternative B
Incorrect. The chafe guard (spril wrap) is placed on the CSD oil supply and return lines to prevent chafing.

Feedback for alternative C
Incorrect. The chafe guard (spril wrap) is placed on the CSD oil supply and return lines to prevent chafing.

Feedback for alternative D
Incorrect. The chafe guard (spril wrap) is placed on the CSD oil supply and return lines to prevent chafing.

****
19. Item 1089: Multiple Choice Question

What components pass through the left dome strut?

A. The electrical lead and the CSD oil drain line.
B. The electrical lead and the CSD oil supply line.
C. The electrical lead and the CSD oil return line.
D. The CSD oil supply and oil return lines.

Correct response is: A

Feedback for alternative A
Very Good.

Feedback for alternative B
Incorrect. The electrical lead and CSD oil drain line passes through the left dome strut.

Feedback for alternative C
Incorrect. The electrical lead and CSD oil drain line passes through the left dome strut.

Feedback for alternative D
Incorrect. The electrical lead and CSD oil drain line passes through the left dome strut.

****
20. Item 1090: Multiple Choice Question

How is the CSD drain hose secured to the CSD?

A. By the oil drain fitting.
B. By the oil drain reducer.
C. By a fitting extending from the CSD filter.
D. By a fitting on the CSD housing.

Correct response is: A

Feedback for alternative A
Very Good.

Feedback for alternative B
Incorrect. The oil drain fitting secures the CSD drain hose to the CSD.

Feedback for alternative C
Incorrect. The oil drain fitting secures the CSD drain hose to the CSD.

Feedback for alternative D
Incorrect. The oil drain fitting secures the CSD drain hose to the CSD.

****
21. Item 1091: Multiple Choice Question

What item(s) are installed to prevent chafing of the electrical harness and the CSD oil drain line?

A. Spacers and seal.
B. Adel clamps.
C. Chafe guard.
D. Spacers only.

Correct response is: A

Feedback for alternative A
Very Good.

Feedback for alternative B
Incorrect. A seal and spacers are installed to prevent chafing of the electrical harness and the CSD oil drain line.

Feedback for alternative C
Incorrect. A seal and spacers are installed to prevent chafing of the electrical harness and the CSD oil drain line.

Feedback for alternative D
Incorrect. A seal and spacers are installed to prevent chafing of the electrical harness and the CSD oil drain line.